

Interactive comment on “Ammonia in the summertime Arctic marine boundary layer: sources, sinks and implications” by G. R. Wentworth et al.

Anonymous Referee #2

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This is a comprehensive paper with interesting results. Although a bit long/wordy in places, the text is clear and easy to follow. I recommend publication if the comments below are addressed.

General Comments: I see no reason to present these gas and aerosol composition data using mass units. Converting mass to moles would make for a more intuitive dataset and enable comparison with recent publications such as Johnson et al (2008).

Inlet location: There are two issues that need to be addressed. Firstly, how far forward is the inlet? The text is a little vague: “mounted to the hull near the bow of the ship”. This is particularly important when it comes to choosing the wind sector to ex-

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clude/include data. If the inlet is very close to the bow +/-90 degrees is probably ok. If it is further back, I'd recommend a more stringent wind sector.

Secondly, if the inlet height was only 1 m above the deck then adverse wind/wave conditions could have caused substantial contamination of the signals. Sea spray generated by the ship plunging into the waves tends to come right up over the bow in these conditions. I assume the conditions in summer were benign but this should be stated more explicitly. In future I recommend mounting the inlet higher up, above the wave spray zone!

Specific Comments: Page 29976, Line 18: What does 'area-wide nature' mean?

Page 29981, Line 19: As far from the side of the ship or as far from the side of the melt pond? Please specify.

Section 3.2: Sulphate neutralisation. I would like to see some scatter plots (or a correlation analysis) of gas phase NH_3 vs particulate NH_4 and gas phase NH_3 vs the degree of aerosol neutralisation ($\text{NH}_4:\text{SO}_4$ ratio). Assuming the analysis in Figure 5 is correct, the cruise data should follow a similar trend – i.e. higher NH_4 concentrations/greater aerosol neutralisation when gas phase NH_3 concentrations increased.

Figure 5: Surely it should be $2 \cdot \text{NH}_4 / \text{nssSO}_4$? This would give a neutral value of 1. I think a ratio of $\text{NH}_4 / 2 \cdot \text{nssSO}_4$ will give a much lower value when the aerosol is neutralised. Also, has there ever been a comparison between AIMS-IC and High Vol filter samplers? In other words, could High Vol. particulate NH_4 measurements be confounded if gas phase NH_3 concentrations were high? This is worthy of discussion given the inclusion of High Vol. data in Figure 5.

Page 29990, Line 15: The Bouwman flux estimate uses a seawater NH_x climatology and, crucially, assumes that the atmospheric NH_3 concentration is zero. This leads to an overestimate of the oceanic NH_3 emissions. Using a different flux estimate would make the discrepancy in NH_3 mixing ratio between the model and the data even greater

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than stated. It would be worth including reference to the recent paper by Paulot et al (GBC, 2015), which demonstrates this overestimate using different NH₃ emission schemes within the GEOS-Chem model.

Section 3.4: Implications for N-deposition. This is an interesting discussion, but it feels incomplete as no attempt is made to include the particulate NH₄ deposition. The particulate NH₄ contribution is likely to be from the same source (i.e. volatile gas phase NH₃ is emitted from seabird colonies. Some neutralises whatever SO₄ aerosol is present, and the rest remains in the gas phase).

Page 29995, Line 25: Typo – remove the word ‘a’ from between ‘slightly’ and ‘higher’

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 29973, 2015.

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